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ABSTRACT

The purpose of this research is to evaluate the effectiveness of the area (homogeneous) scales of the Navy Vocational Interest Inventory (NVII) as predictors of Class "A" school achievement and as measures of rating differentiation by comparing specific occupational scales with more general interest measures--the NVII area scales. The NVII was administered experimentally to samples of incoming students at six Class "A" schools varying widely in curriculum and to a sample of students in the Submarine School. In addition to NVII area scales, scores on Basic Test Battery (BTB) subtests were available for men in each school. Multiple correlations were computed, thus allowing validity comparisons of the BTB in predicting Class "A" school achievement to be made with and without the addition of NVII area scales. These multiples were compared to multiples obtained using occupational key scores. Average area scale profiles of the various occupational groups were compared to those obtained using occupational key profiles. The area scales were found to be as effective as occupational scales in differentiating the interest patterns of men in various schools and to contribute significantly to the prediction of Class "A" school achievement. It was concluded that the differences between the two types of scales were not substantial. (Author)

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AREA SCALES OF THE NAVY VOCATIONAL INTEREST INVENTORY AS PREDICTORS OF SCHOOL PERFORMANCE AND RATING ASSIGNMENT

Alan W. Lau
Norman M. Abrahams

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Alan W. Lau
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SUMMARY

A. Problem

The purpose of this research is to evaluate the effectiveness of the area (homogeneous) scales of the Navy Vocational Interest Inventory (NVII) as predictors of Class "A" school achievement and as measures of rating differentiation.

B. Background

In earlier research, empirically derived NVII occupational keys were found to differentiate effectively between men in various Class "A" schools on the basis of interest scores, and to contribute significantly toward the prediction of school achievement. The present research compares the effectiveness of the specific occupational scales with more general interest measures--the NVII area scales--in predicting these criteria.

C. Approach

The NVII was administered experimentally to samples of incoming students at six Class "A" schools varying widely in curriculum and to a sample of students in the Submarine School. In addition to NVII area scales, scores on Basic Test Battery (BTB) subtests were available for men in each school. Multiple correlations were computed, thus allowing validity comparisons of the BTB in predicting Class "A" school achievement to be made with and without the addition of NVII area scales. These multiples were compared to multiples obtained using occupational key scores. Average area scale profiles of the various occupational groups were compared to those obtained using occupational key profiles.

D. Findings, Conclusions, and Recommendations

The area scales were found to be as effective as occupational scales in differentiating the interest patterns of men in various schools (page 5). The area scales were also found to contribute significantly to the prediction of Class "A" school achievement (page 5). It was concluded that the differences between the two types of scales were not substantial.

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AREA SCALES OF THE NAVY VOCATIONAL INTEREST INVENTORY AS PREDICTORS OF SCHOOL PERFORMANCE AND RATING ASSIGNMENT

A. PURPOSE AND BACKGROUND

As part of a program to evaluate non-cognitive tests for use in recruit classification, the Navy Vocational Interest Inventory (NVII) was recently validated against Class "A" school achievement and analyzed for its ability to differentiate men in various ratings (Abrahams, Lau, & Neumann, 1968). It was found that the 19 empirically derived occupational keys developed by Clark (1953) effectively differentiated men in various Class "A" schools on the basis of interest scores. Occupational keys were also found to contribute significantly toward the prediction of Class "A" school achievement. These findings were in agreement with earlier reports (Clark, 1955; Clark, 1961; Albitz, 1958; Spies, 1966).

Clark developed these occupational keys on the basis of how well they differentiated between the interests of men in a general reference group and criterion groups of men who were members of specific Navy ratings. A key was considered effective if the items within it successfully separated men in the criterion group from men in the reference group. The scores that a man earns on the occupational keys indicate the degree to which his interests resemble those of men in various Navy ratings. Although it is justifiable to say that a man who scores high on the Hospitalman (HM) key has interests like rated HMs, one of the shortcomings of occupational keys is the difficulty in making any generalizations about the underlying trait structure of interest patterns. Another shortcoming is the amount of work necessary to construct and score keys for all of the Navy schools. Some occupational keys have substantial correlations with others, and consequently it may be possible to describe the essential variation in patterns of interest scores by use of a smaller number of keys.[1]

To alleviate these shortcomings, Clark developed homogeneous, or area scales, by identifying clusters of items that were related to one another. The advantage of these scales is that they draw together items with a common core into homogeneous groupings, thus providing relatively "pure" indicators of traits or factors measured by the NVII. The nine area scales developed by Clark include Mechanical, Health Service, Office

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[1]To some degree, this was accomplished when Clark reduced the number of occupational keys from 19 to 13 by deleting keys when they were highly related to other keys.

Work, Electronics, Food Service, Carpentry, Sales-Office, Clean Hands, and Outdoors. A brief description of each scale is presented in the Appendix.

Although several attempts have been made to predict Class "A" school achievement using occupational keys, no studies have utilized area scales for predicting this criterion. The purpose of this report is to validate the area scales against Class "A" school achievement and to compare their validity with occupational keys. In addition, area scales are analyzed for their ability to differentiate the interest patterns of men in different ratings.

B. PROCEDURE

In 1964 and 1965, the NVII was administered to recruits at six different Class "A" schools prior to the beginning of training. These six schools were Hospitalman (HM), Electronics Technician (ET), Yeoman (YN), Storekeeper (SK), Engineman (EN), and Machinist's Mate (MM). In addition, the test was administered to a sample of recruits in the Submarine School. NVII scores were obtained on the nine area scales. In addition to NVII scores, scores on the Basic Test Battery (BTB) subtests and Final School Grades (FSG) were obtained for men in each school. An intercorrelation matrix was computed for each school. Three multiple regression analyses were completed for each school. The first analysis involved only the nine NVII area scales; the second included only BTB scores, and the third included both BTB and NVII scores. From these analyses, multiple correlations for various composites were computed, thus allowing validity comparisons with and without the NVII scales.

In addition, mean profiles on all area scales for men in each school were developed. This permitted an evaluation of the area scales' ability to discriminate similarities and differences in measured interests that characterized recruits in the various schools.

C. RESULTS AND DISCUSSION

1. NVII Validity

a. Individual scales. Table 1 presents area scale means, standard deviations, and correlations with FSG for all NVII scales within each school. On the scales judged to be most relevant for each school, correlations ranged from .06 to .31, with a median correlation of .15. In only the HM and SK schools, however, was the scale judged to be most relevant the best single predictor of FSG.

b. Combined NVII area scales. Table 2 presents the results of seven multiple regression analyses, one for each school, using all NVII

TABLE 1

NVII Area Scale Means, Standard Deviations, and Correlations With Final School Grade by Rating

	HM School (N=239)			ET School (N=97)			YN School (N=93)			SK School (N=77)			EN School (N=94)			MM School (N=73)			Submarine School (N=168)		
	$\bar{X}$	S.D.	r	$\bar{X}$	S.D.	r	$\bar{X}$	S.D.	r	$\bar{X}$	S.D.	r	$\bar{X}$	S.D.	r	$\bar{X}$	S.D.	r	$\bar{X}$	S.D.	r
1. Mechanical (N=22)[a]	3.3	3.2	-.05	12.5	5.7	.02	2.5	3.0	-.15	4.1	4.2	-.11	16.4	3.9	.21[b]	13.0	5.4	.14[b]	13.5	5.7	.06[b]
2. Health Service (N=19)	15.7	4.0	.31[b]	5.1	4.1	.10	4.0	3.4	-.13	3.5	4.2	-.06	2.9	2.7	-.09	4.9	4.2	.14	5.7	4.8	.06
3. Office Work (N=20)	5.1	3.8	-.10	4.0	4.0	.07	14.5	4.8	.14[b]	12.9	5.5	.23[b]	2.4	2.4	-.25	3.4	3.7	-.26	3.3	3.6	-.17
4. Electronics (N=17)	3.0	2.7	.03	12.1	3.5	.15[b]	3.0	2.2	-.11	3.9	2.8	-.09	8.3	3.5	.13	8.5	3.8	-.05	9.7	4.3	-.02
5. Food Service (N=20)	6.4	4.0	.04	4.8	3.7	-.07	4.4	3.3	.06	4.5	3.4	-.07	4.9	3.1	-.13	5.2	3.5	-.02	4.0	3.3	-.03
6. Carpentry (N=18)	4.2	2.6	-.15	4.0	2.5	-.22	6.1	2.8	.07	6.5	3.0	-.04	7.7	3.6	-.07	6.0	3.7	-.01	4.8	3.1	-.07
7. Sales-Office (N=17)	7.0	2.5	.23	5.2	2.6	.20	6.2	2.7	.09	5.6	2.3	.02	3.2	2.0	-.04	5.0	2.5	.17	5.3	2.6	.17
8. Clean Hands (N=15)	5.1	2.1	-.13	3.7	2.1	-.02	6.6	2.1	-.04	7.0	2.4	-.14	3.0	2.0	-.11	3.9	2.2	-.21	3.5	2.2	-.13
9. Outdoors (N-15)	5.5	2.6	-.05	7.4	2.6	-.11	4.9	2.4	-.11	5.5	2.4	-.22	9.4	2.1	.04	8.0	2.6	.10	8.1	2.6	-.06

Notes --

Table entries are in raw score units.

[a]Number of items in each area scale is given in parentheses.

[b]Correlations between scales judged most relevant and Final School Grade for each school are underlined.

TABLE 2

Combined NVII Area Scales Versus Best Single NVII Area Scale Validity for Each School in Predicting Final School Grade

School	N	Best Single NVII Area Scale	NVII Area Scale Multiple	Absolute Increase	p[a]
(HM) Hospitalman	239	.31 (Health Service)[b]	.37	.06	.01
(ET) Electronics Technician	97	-.22 (Carpentry)	.27	.05	N.S.[c]
(YN) Yeoman	93	-.15 (Mechanical)	.21	.06	N.S.
(SK) Storekeeper	77	.23 (Office Work)	.42	.19	.01
(EN) Engineman	94	-.25 (Office Work)	.28	.03	N.S.
(MM) Machinist's Mate	73	-.26 (Office Work)	.35	.09	.05
Submarine	168	-.17 (Office Work)	.27	.10	.01

Notes --

[a]Significance of increase was determined between single scale validity and R's based upon more than one scale (McNemar, 1960, p. 279).

[b]Scale names in parentheses indicate the scale on which validity is based.

[c]N.S. indicates non-significant increase.

scales in combination. These multiples are compared to the validities of the single most valid scales which, as noted above, were generally not the scales judged most relevant for that school.

The correlations between the best single scales and FSG ranged from .15 to .31, with a median of .23. Combining additional scales significantly increased the correlation with FSG over that found with the best single scale in the HM, SK, MM, and Submarine schools. These multiple correlations ranged from .21 for the YN School to .42 for the SK School, with a median correlation of .28. Composites produced a median increase of .06 correlation points over the best single scale.

2. BTB Plus NVII Scales

Table 3 shows the results for each school when BTB scores and NVII area scales were combined to predict FSG. The basic question is how much the NVII scales can supplement BTB measures in the multiple regression equations.

With only one exception, that of the YN School sample, NVII area scales contributed significantly toward the prediction of FSG. Significant increases ranged from .02 in both the EN and Submarine schools to .19 correlation points for the SK School sample. When area NVII scores were added to BTB scores, the median increase was .04 correlation points.

3. Occupational Versus Area NVII Scales

With reference as to whether area scales or occupational keys provided more effective prediction of FSG, the results indicated that a composite of occupational keys yielded somewhat higher median multiple correlations with FSG (R's = .36 versus .28).[2] However, there were no substantial differences between the validities of the area scales judged to be most relevant for each school and the validities of the empirically constructed relevant keys. There were also no substantial differences between the validities of the single most valid area scales and the single most valid occupational keys. Further, when area and occupational scores were combined with BTB scores, the median increase in both cases was .04 correlation points.

Relevant occupational and area scales were compared on their ability to separate men in the various schools. This was done by computing for each type scale the amount of overlap between scores that men in each school earned on their own relevant scale and the scores earned by men in the other schools on the same scale. For example, men in the EN School earned a mean score of 58.34 on the EN key and men in the ET School

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[2]The results on the validity of occupational keys are abstracted from an earlier report (Abrahams, Lau, & Neumann, 1968).

TABLE 3

BTB Validity Versus Combined BTB-NVII Validity for Each School in Predicting Final School Grade

School	N	BTB Multiple	NVII-BTB Multiple	Increase	p[a]
(HM) Hospitalman	239	.54	.58	.04	.01
(ET) Electronics Technician	97	.38	.44	.06	.05
(YN) Yeoman	93	.31	.31	---	N.S.[b]
(SK) Storekeeper	77	.30	.49	.19	.01
(EN) Engineman	94	.66	.68	.02	.05
(MM) Machinist's Mate	73	.49	.59	.10	.05
Submarine	168	.48	.50	.02	.06

Notes --

[a]Significance of increase was determined between single scale validity and R's based upon more than one scale (McNemar, 1960, p. 279).

[b]N.S. indicates non-significant increase.

a score of 48.18 on the EN key. The overlap between the score distributions was 50 per cent. On the Mechanical area scale, ENs earned a mean score of 16.4 and ETs a mean score of 12.5, the overlap being 77 per cent. In this case, the empirical EN key was more effective in differentiating the interests of ETs and ENs than the relevant Mechanical area scale. In general, it was found that relevant occupational keys were somewhat more effective than relevant area scales, particularly in closely related mechanical or technical activities. This is probably because of the fine distinctions between these ratings which make it difficult to develop area scales which will classify men in closely related occupations as well as occupational keys. On the other hand, area scales appeared to be somewhat more effective than occupational keys in separating men in unrelated schools such as ETs and HMs. When relevant scales were compared over all schools, there were no differences between the two types of scales.

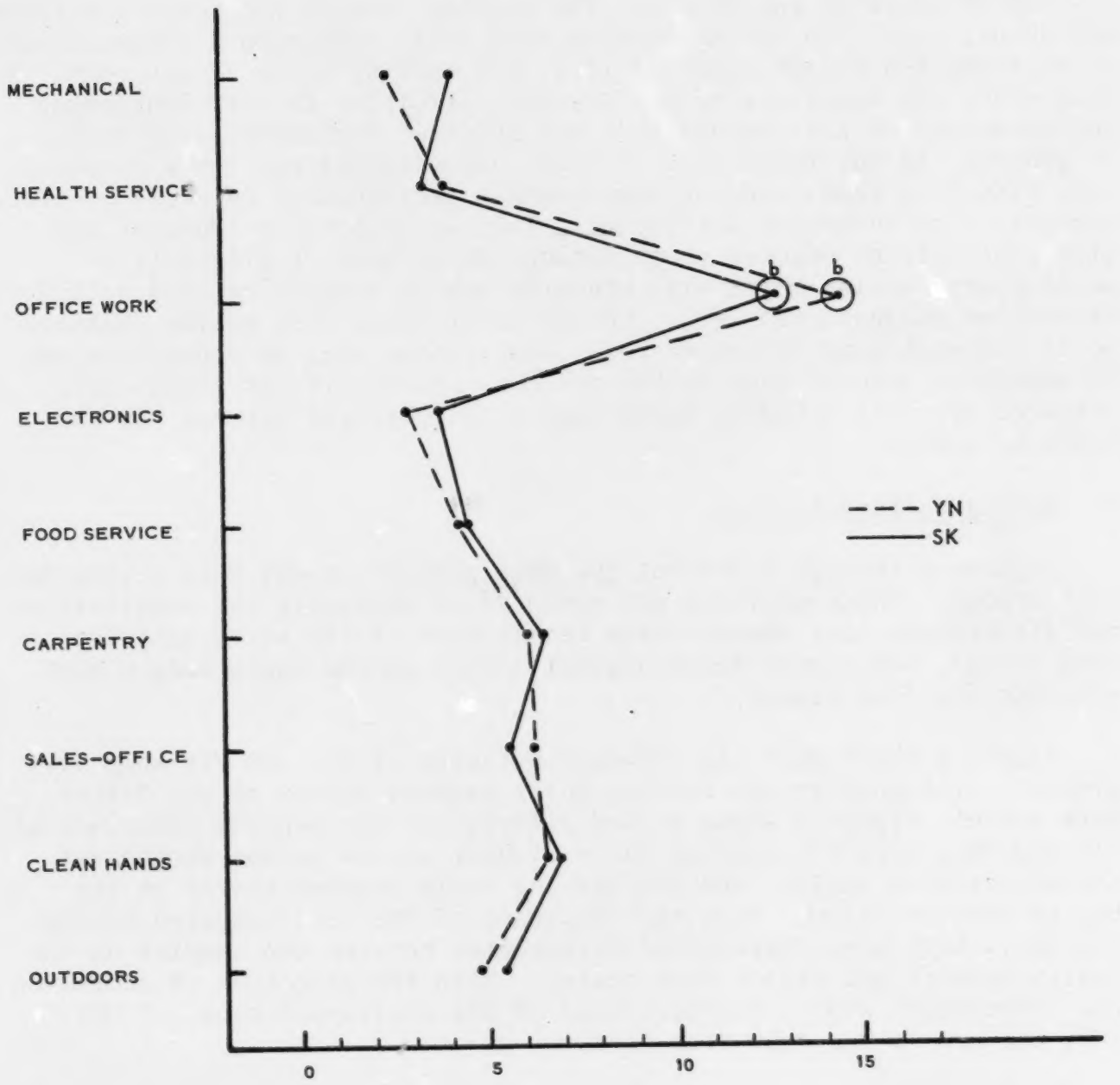
4. Rating Differentiation

Figures 1 through 3 present the mean profile on all area scales for each school. These profiles are arranged to emphasize the similarities and differences that characterize men in each of the seven schools. In each school, men earned their highest scores on the scale judged most relevant for that school.

Figure 1 shows that the interest patterns of YNs and SKs were very similar, with both groups earning their highest scores on the Office Work scale. Figure 2 shows marked differences between the responses of ETs and HMs, with ETs earning their highest scores on the Mechanical and Electronics scales, and HMs earning their highest scores on the Health Service scale. When the responses of HMs were compared to YNs and SKs, there were substantial differences between the samples on the Health Service and Office Work scales. With the exception of scores on the Electronics scale, the responses of ETs overlapped those of MMs, ENs, and men in the Submarine School.

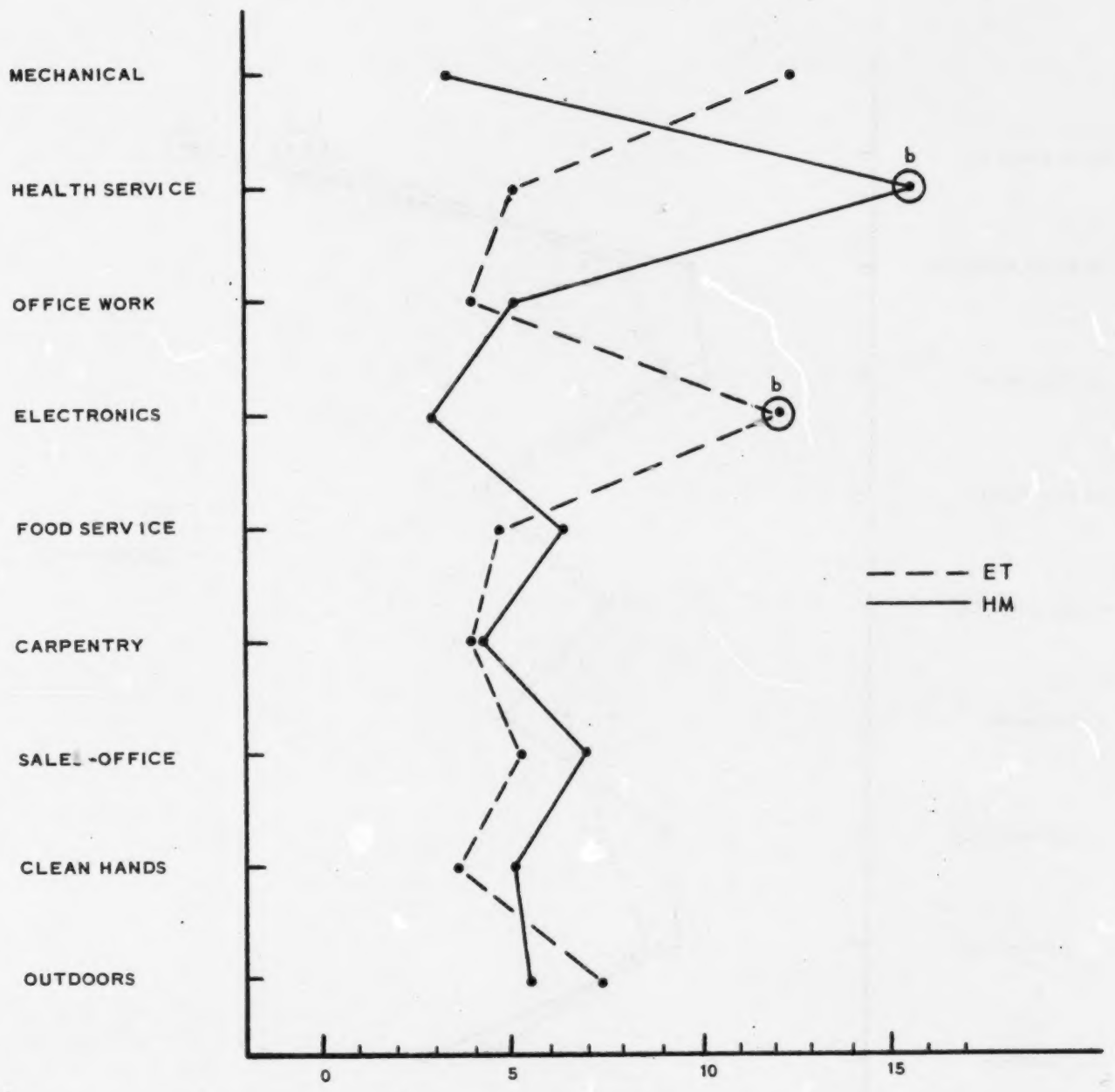
Figure 3 indicates that the interest patterns of men in the Submarine, MM, and EN schools are very similar, with all three samples earning their highest scores on the Mechanical scale. There was very little overlap between the responses of men in these three schools with men in the YN, SK, or HM schools.

These profiles indicated that NVII area scale scores effectively differentiated among men in these school samples, and emphasized the fact that real differences in interest patterns existed among these groups. Area scores provided a somewhat clearer picture of the nature of differences in group interest patterns than occupational keys, but these profiles parallel those reported in an earlier study where NVII occupational key profiles were presented (Abrahams, Lau, & Neumann, 1968).



Note .....
a Table entries in raw score units
b Profile point on scale most relevant to each sample indicated by circle : O

Figure 1. Mean NVII Area Profiles on all Scales for Yeoman (YN) and Storekeeper (SK) School Samples.

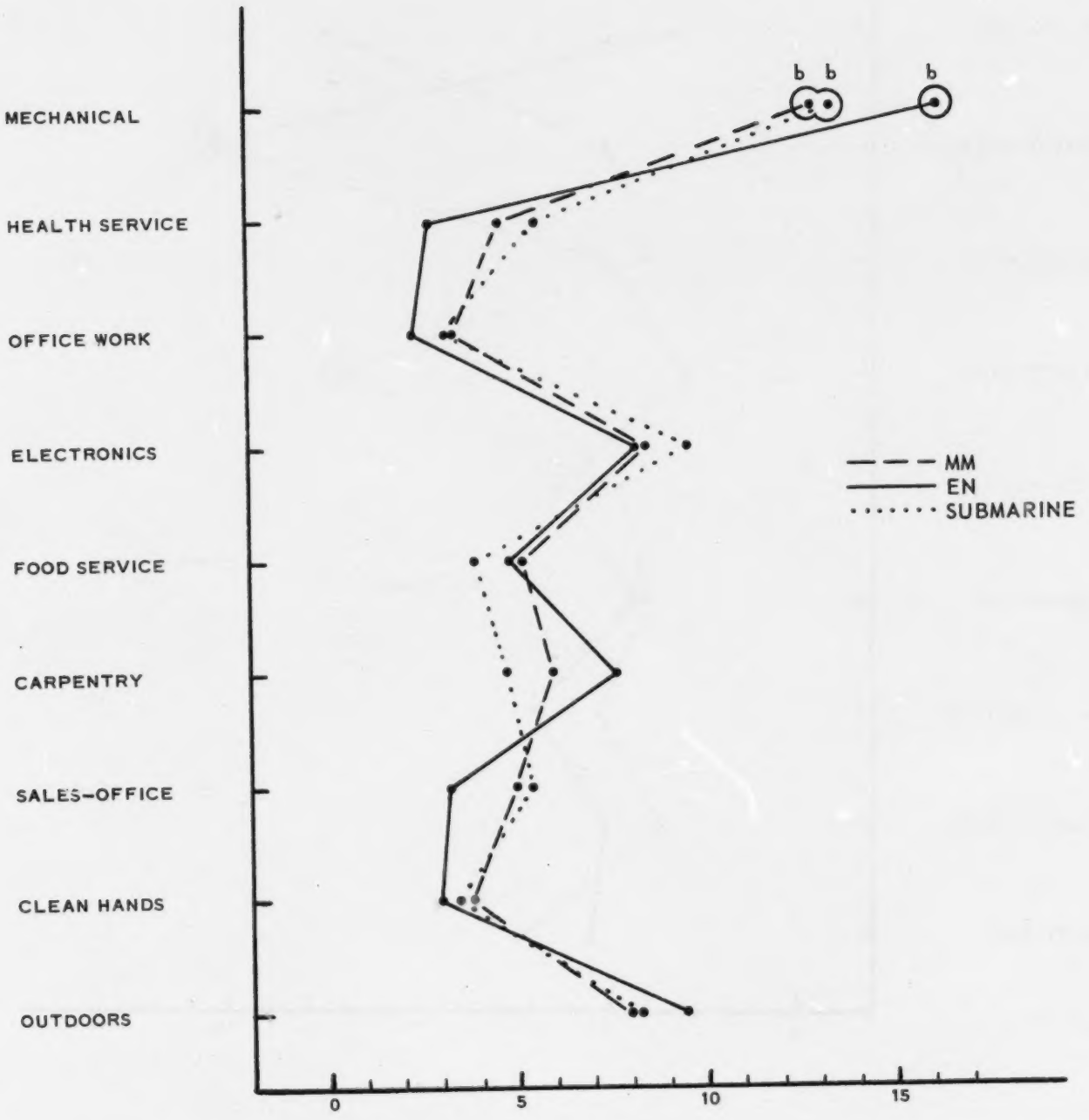


Note .....

a Table entries in raw score units

b Profile point on scale most relevant to each sample indicated by circle : O

Figure 2. Mean NVII Area Profiles on all Scales for Hospitalman (HM) and Electronics Technician (ET) School Samples.



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a Table entries in raw scale units
b Profile point on scale most relevant to each sample indicated by circle :O

Figure 3. Mean NVII Area Profiles on all Scales for Machinist's Mate (MM), Engineman (EN), and Submarine School Samples.

D. CONCLUSIONS

NVII area scales were found to be significantly related to Class "A" school achievement. Correlations between scales judged most relevant ranged from .06 to .31, with a median correlation of .15. In general, combining several area scales into composites significantly improved prediction.

When area scales were combined with BTB scores, significant increases were obtained for all but the YN School sample. The median increase was .04 correlation points.

With reference to the effectiveness of occupational and area scales in predicting school achievement, it was concluded that the differences between the two types of scales were not substantial, and that both contributed significantly toward the prediction of achievement.

In general, the NVII area scales were as effective as occupational keys in differentiating among the interest patterns of men in the various school samples. Since the area scales provide easily interpretable and relatively "pure" scores on nine interest factors, it would appear that these scores might be better suited for recruit classification than scores on the occupational keys.

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APPENDIX

The following paragraphs describe the content of each of the nine NVII area scales.

Mechanical

These items are about mechanical things, machine operation and design, or home repairs of mechanical and electrical gadgets.

Health Service

This scale shows interests in medical and hospital service, or in working in medical or chemical laboratories.

Office Work

This scale shows interests in clerical work, office machines, bookkeeping and accounting, or in office management.

Electronics

These items deal with the building and operation of radio and other electronic equipment.

Food Service

These items are concerned mainly with menu planning and preparing food.

Carpentry

This cluster deals with carpentry and furniture making. Some items show a dislike for electrical-electronics or medical-chemical activities.

Sales-Office

Two clusters are covered by these items. The largest deals with speaking and writing; the other indicates interests in art and music. Other items show an interest in people; some show socially accepted, "highly thought of" activities.

Clean Hands

There is no simple theme in these items. They seem to measure one's preference for "clean hands" activities.

Outdoors

Most items in this scale show interests in athletics and outdoor activities. A second group deals with unskilled manual jobs and home repairs. They indicate dislike of feminine, indoor, verbal, and complex tasks.

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